

Western Wind and Solar Integration Study Phase 2

Sept 12, 2012 Technical Review Committee Meeting

Agenda – Debbie Lew, NREL

- Data Inputs
- Transmission database
- Preliminary results
- New Schedule
- New GE and APTECH work

Presentation is at: <http://wind.nrel.gov/public/WWIS/2012-09-12.pdf>

Data Inputs – Debbie Lew, NREL

- Original 3TIER WWSIS1 wind forecasts were adjusted to match measured forecast error distributions from CAISO, ERCOT and Xcel. This was done to reflect current forecasting expertise and to adjust for a forecasting bias that was inherent in the original forecast dataset. The revised forecasts have a slight bias but not at the 10-15% level that was seen in the original dataset. Note that measured forecasts have a bias as well. The tails of the revised dataset should match up well with measured forecast error distributions.
- Original 3TIER WWSIS1 solar forecasts were checked against new forecasts by SUNY Albany. Because error distributions were similar and because we had no BA-level solar forecast error distributions, we did not adjust solar forecasts. There is greater bias in the solar than in the wind forecasts.

Transmission Database – Debbie Lew and Greg Brinkman, NREL

Transmission

- NREL/Plexos EIM study found that there are 1500 lines in the Plexos database that will not be operational in the 2020 timeframe. This is out of a total of 20,000+ lines in WECC. This has been corrected in the final EIM study. The revised transmission Plexos database still contains the foundational lines but the optional and potential lines are removed.
- WWSIS2 differs from EIM. WWSIS2 is zonal, with interface limits defined between zones. EIM was run nodally and there may have been lines that did not have limits imposed. For WWSIS2, only the PTDF matrix will change.
- WWSIS2 does see potential loop flow in Mexico because San Diego not getting cheap power from east. If remove the erroneous line between NM and Mexico, that loop flow should go away.
- Greg Brinkman suggests re-running Plexos runs for each scenario but not to re-run the transmission buildouts. Consensus that this makes most sense. Later in the call Tom Duane suggests checking the transmission buildouts to ensure they make sense and re-running only if necessary.

Model setup

- Greg Brinkman up the Plexos model with a day-ahead (DA) and 4 hour-ahead (4HA) unit commitment and 5 min real time (RT) dispatch. Shucheng Liu asked what is different between DA and 4HA commitment? It is the wind and solar forecasts. We assume load forecasts are perfect.
- Hydro is scheduled with the medium term Plexos model that looks at one month at a time.
- Original hydro model adjustment caused hydro to redispatch too frequently so now there is a single increment or decrement of hydro up to mingen or maxgen, depending on LMP
- There are some hours when curtailment occurs and price is zero
- We are running 2006 projected out to 2020, matching day of week pattern of 2020

Preliminary Results – Greg Brinkman, NREL

- Got new Plexos code a month ago and tested extensively to make sure it was robust and correct.
- Note that wind and solar energy penetration is 33% of US load, not 33% of WECC load, because of inadequate Canada and Mexico data to model wind and solar resources there.

Base (3% solar, 8% wind) case and HiMix (16.5% solar, 16.5% wind) case

- Reserves are held differently in WWSIS2 from WWSIS1. For WWSIS2, Regulating reserves are shared across all of WECC (to mimic Reliability Based Control) and Flexibility and Contingency reserves are held by zone (20 zones represent the BA's in WECC). Note that no Flexibility reserves were held in the base cases of WWSIS1.
- Contingency reserves faced slight shortfalls, in SF and CO.
- System adequacy – no unserved load or unserved regulating reserves.
- Flex reserves were held in DA and HA and released in RT
- Steve Lefton asked about G&T buildouts. Transmission was builtout based on shadow prices across interfaces. Generation buildout was based on REEDS capacity expansion model.
- Ron Flood asks if there is a different transmission buildout for each case. Yes. Greg will send Ron the comparison of transmission buildouts.
- Hydro needed some tweaking. Greg had to iterate several times to get hydro production consistent. This required slightly different price threshold for hydro redispatch in the base case versus the high renewables cases.
- Gary Jordan said we could run 1-2 months allowing versus dis-allowing hydro redispatch and see if there are benefits to the system
- Ron Flood asks about operational limits on hydro? We use TEPPC limits for min and max hydro for each month
- Greg sees some strange prices in RT model. So he is investigating this now.

- Base case (11% VG) sees average production cost in July of about 19\$/MWH and Hi Mix (33% VG) case sees \$15/MWH. This yields a value of the incremental wind and solar of about \$34/MWH for July.
- Used TEPPC 2022 assumptions for NG because 2020 gas price too high
- Bob Hess suggests dividing production cost of non-RE units by their production. That would result in increased cost of those units
- Gary Jordan confirms that the production cost is fuel and startup costs. No costs for emissions.
- Mark O'Malley suggests we look at the difference between value of first 11% VG vs incremental 22% VG.
- Brad Nickell says since we've only looked at July, value of renewables is likely to be lower 'value' when look at whole year. Suggests we revise slides to specify 'July'. This has been completed.
- Gary Jordan suggests showing the average production cost for coal, gas, CT
- Bob Hess asks about nukes. Greg explains we don't allow nuke to go below 95% in any case.
- Number of starts is less for HiMix. Renewables displace gas, so we don't need to start up as much. But for coal, there are more starts as we start to displace coal.
- Gary Jordan says there are two opposing drivers in cycling: RE gen pushing starts down and forecast error pushing CT's starts up.
- There was discussion about how to present the start-ups data. Sundar Venkataraman suggests number of starts as a ratio, e.g. like generation per start or hours per start. Steve Lefton likes hours per start. He says they see more starts for CT's with more RE on the system.
- Must-run CT's: cogen and must-run reliability units. Gary Jordan suggests dividing the CT's into must-run and non-must-run CT's. Tao Guo and Greg Brinkman are not sure if they are RMR units. Brad Nickell said the RMR units are flagged for voltage or inertial support in critical areas, but he's not sure the granularity as to what part of the year you can flag or not flag RMR unit
- Steve Lefton suggests we stack coal on bottom, just above nukes because it's hard to see
- Gary Jordan suggests a deep dive into turndowns. Capacity factor alone doesn't tell us enough. Are the units dropping to 60% and staying or are they up and down a lot.
- Greg agrees and explains that we will apply the APTECH ramping costs to these
- Steve Lefton thinks low minimums are fairly inexpensive. Below min load, there is small amount of cost and great benefit. That may be the low hanging fruit. That implies faster ramping though. So we may need 'hold points'.
- Bob Hess asks if Plexos can anticipate damage from cycling. Do we need a feedback loop in Plexos. Steve Lefton says his model can optimize this.
- Steve Lefton is studying a WECC nuke and is examining the cost to ramp down to 80/60/40/20% gen. He thinks we ought to be able to do 95% or even 85% as option.

- Bob Hess – is turning a nuke down the same as spilling energy?
- Steve- you will be throwing away fuel price.

New Schedule – Debbie Lew, NREL

- Agreement to revise transmission database to eliminate extra lines, similar to EIM revisions. Re-run core scenarios and complete end Sept.
- Finalize analysis of core scenario results in Oct
- Draft report to TRC/DOE in end Oct/early Nov.
- Sometime in Nov, we will hold a full-day TRC meeting to present results. Ron Flood asks for time to review report in advance of this meeting. Debbie says while we will ensure sufficient time for report review, scheduling this meeting will depend on everyone's schedules, so we don't know whether the meeting will be earlier or later during the report review process.
- December – final report complete on core scenarios.

New GE/APTECH work – Debbie Lew, NREL

- GE and APTECH have started determining potential retrofits or operational strategies to increase the flexibility of the fossil fleet.
- NREL will run these new scenarios.
- GE will use this to determine a cost-benefit analysis of retrofits.

Participants

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